# Chapter 1.11
# Evaluation of Decision-Making Support Systems

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## INTRODUCTION

Decision support systems (DSSs) have been researched extensively over the years with the purpose of aiding the decision maker (DM) in an increasingly complex and rapidly changing environment (Sprague & Watson, 1996; Turban & Aronson, 1998). Newer intelligent systems, enabled by the advent of the Internet combined with artificial-intelligence (AI) techniques, have extended the reach of DSSs to assist with decisions in real time with multiple informaftion flows and dynamic data across geographical boundaries. All of these systems can be grouped under the broad classification of decision-making support systems (DMSS) and aim to improve human decision making. A DMSS in combination with the human DM can produce better decisions by, for example (Holsapple & Whinston, 1996), supplementing the DM's abilities; aiding one or more of Simon's (1997) phases of intelligence, design, and choice in decision making; facilitating problem solving; assisting with unstructured or semistructured problems (Keen & Scott Morton, 1978); providing expert guidance; and managing knowledge. Yet, the specific contribution of a DMSS toward improving decisions remains difficult to quantify.

Many researchers identify a single metric, or a series of single metrics, for evaluation of the DMSS in supporting decision making, if it is evaluated at all (Phillips-Wren, Mora, Forgionne, Garrido, & Gupta, 2006). The authors suggest outcome criteria such as decreased cost, or process criteria such as increased efficiency, to justify the DMSS. Yet no single integrated metric

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is proposed to determine the value of the DMSS to the decision maker.

The objective of this article is to review literature-based evaluation criteria and to provide a multicriteria evaluation model that determines the precise decision-making contributions of a DMSS. The model is implemented with the analytical hierarchy process (AHP), a formalized multicriteria method.

Building on other core studies (Forgionne, 1999; Forgionne & Kohli, 2000; Keen, 1981; Leidner & Elam, 1993; Money, Tromp, & Wegner, 1988; Phillips-Wren & Forgionne, 2002; Phillips-Wren, Hahn, & Forgionne, 2004; Phillips-Wren, Mora, Forgionne, Garrido, et al., 2006; Phillips-Wren, Mora, Forgionne, & Gupta, 2006; Pieptea & Anderson, 1987), this article focuses on the performance and evaluation of a planned or real DMSS in supporting decision making. Unlike previous DSS studies (Sanders & Courtney, 1985; Leidner, 1996; Wixom & Watson, 2001; Mora, Cervantes, Gelman, Forgionne, Mejia, & Weitzenfeld, 2002) or general information-system studies (DeLone & McLean, 1992, 2003), this study develops a DMSS evaluation model from a design research paradigm, that is, to be built and evaluated (Hevner & March, 2003).

## BACKGROUND

Although developers of DMSSs generally report a single criterion for a DMSS, the use of multiple criteria to evaluate a DMSS has been reported in the literature. Chandler (1982) noted that information systems create a relationship between users and the system itself, so that its evaluation should consider both user and system constraints. He developed a multiple-goal programming approach to consider trade-offs between goals and performance. Adelman (1992) proposed a comprehensive evaluation for assessing specifically DSSs and expert systems using subjective, technical, and empirical methods to form a multifaceted approach. User and sponsor perspectives were included in the subjective methods. The analytical methods and correctness of the analysis were assessed in the technical evaluation. Finally, a comparison of performance with and without the system was evaluated in the empirical-methods section. The three approaches were combined to form an overall evaluation of the system. Turban and Aronson (1998) indicate that information systems, including DMSSs, should be evaluated with two major classes of performance measurement: effectiveness and efficiency. According to general systems principles (Checkland, 1999), effectiveness deals with how well the results or outputs contribute to the goals and achievements of the wider system, and efficiency measures how well the system processes inputs and resources to achieve outputs. A third measure, efficacy, deals with how well the system produces the expected outputs. This third measure complements the three general performance or value-based measures for any general system. For example, Maynard, Burstein, and Arnott (2001) proposed evaluating DMSSs by directly including the perspectives of different constituencies or stakeholders in a multicriteria evaluation.

## DECISION VALUE OF DMSS

### Multicriteria Model

Of the many studies of applied DMSSs published in the last 30 years, assessment usually consisted of characteristics associated with either the process or outcome of decision making using a DMSS (Forgionne, 1999; Phillips-Wren, Mora, Forgionne, Garrido, et al., 2006; Phillips-Wren, Mora, Forgionne, & Gupta, 2006). Process variables assess the improvement in the way that decisions are made and are often measured in qualitative terms. Process variables that have been used to judge a DMSS are increased efficiency, user satisfaction, time savings, more

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